

WHAT IS CLAIMED IS:

1 1. A disk control device comprising:
2 a plurality of host interface modules configured to interface with a computer;
3 a plurality of disk interface modules configured to interface with a storage
4 device;
5 a plurality of cache memory modules configured to temporarily store data read
6 from or written to the storage device; and
7 a switch network connecting the host interface modules, the cache memory
8 modules, and the disk interface modules, the switch network comprising at least one switch;
9 wherein each of the host interface modules is configured to execute data
10 transfers between the computer and the cache memory modules, and each of the disk
11 interface modules is configured to execute data transfers between the storage device and the
12 cache memory modules;
13 wherein each of the host interface modules, the disk interface modules, and the
14 cache memory modules includes identification information providing unique identification
15 within the switch network;
16 wherein the switch network includes a memory containing path information
17 based on the identification information for data transfer paths among the host interface
18 modules, the disk interface modules, and the cache memory modules; and
19 wherein each of the cache memory modules is configured to monitor failure in
20 the cache memory module and to control changing of the path information relating to the
21 cache memory module in the memory of the switch network.

1 2. A disk control device as recited in claim 1 wherein each of the host
2 interface modules, the disk interface modules, and the cache memory modules includes at
3 least one identification corresponding to at least one port thereof.

1 3. A disk control device as recited in claim 1 wherein each cache memory
2 module is activated to monitor failure in the cache memory module in tandem with read or
3 write operations in the host interface modules and the disk interface modules.

1 4. A disk control device as recited in claim 1 wherein each cache memory
2 module is configured to control changing of the path information in the memory of the switch
3 network to avoid a failure site when a failure takes place in the cache memory module.

1 5. A disk control device as recited in claim 1 wherein, when one of the
2 cache memory modules detects a failure, the cache memory module replaces the
3 identification information of the failed cache memory module with the identification
4 information of a replacement cache memory module inheriting functions of the failed cache
5 memory module, and wherein the path information for data transfer paths in the memory of
6 the switch network is changed in accordance with replacement of the identification
7 information of the failed cache memory module by the identification information of the
8 replacement cache memory module.

1 6. A disk control device comprising:
2 a plurality of host interface modules configured to interface with a computer;
3 a plurality of disk interface modules configured to interface with a storage
4 device;
5 a plurality of cache memory modules configured to temporarily store data read
6 from or written to the storage device;
7 a plurality of resource management modules configured to store control
8 information relating to data transfer among the cache memory modules and the host interface
9 modules and the disk interface modules; and
10 a switch network connecting the host interface modules, the cache memory
11 modules, the resource management modules, and the disk interface modules, the switch
12 network comprising at least one switch;
13 wherein each of the host interface modules is configured to execute data
14 transfers between the computer and the cache memory modules; and each of the disk
15 interface modules is configured to execute data transfers between the storage device and the
16 cache memory modules;
17 wherein each of the host interface modules, the disk interface modules, the
18 resource management modules, and the cache memory modules includes identification
19 information providing unique identification within the switch network;
20 wherein the switch network includes a memory containing path information
21 based on identification information for data transfer paths among the host interface modules,
22 the disk interface modules, the resource management modules, and the cache memory
23 modules;

24 wherein each of the resource management modules is configured to monitor
25 failure in the resource management module and to control changing of the path information
26 relating to the resource management module in the memory of the switch network.

1 7. A disk control device as recited in claim 6 wherein each of the cache
2 memory modules is configured to monitor failure in the cache memory module.

1 8. A disk control device as recited in claim 7 wherein each of the cache
2 memory modules is configured to control changing of the path information relating to the
3 cache memory module in the memory of the switch network.

1 9. A disk control device as recited in claim 8 wherein each cache memory
2 module is configured to control changing of the path information in the memory of the switch
3 network, when a failure takes place in the cache memory module, to avoid the failed cache
4 memory module.

1 10. A disk control device as recited in claim 6 wherein each resource
2 management module is configured to control changing of the path information in the memory
3 of the switch network, when a failure takes place in the resource management module or in
4 one of the cache memory modules, to avoid the failed resource management module or the
5 failed cache memory module.

1 11. A disk control device as recited in claim 6 wherein each resource
2 management module is configured to monitor failure in the resource management module or
3 in one of the cache memory modules.

1 12. A disk control device as recited in claim 6 wherein each resource
2 management module is activated to monitor failure in tandem with read or write operations in
3 the host interface modules and the disk interface modules.

1 13. A disk control device as recited in claim 6 wherein, when one of the
2 resource management modules detects a failure in the resource management module, the
3 resource management module replaces the identification information of the failed resource
4 management module with the identification information of a replacement resource
5 management module inheriting functions of the failed resource management module, and
6 wherein the path information for data transfer paths in the memory of the switch network is
7 changed in accordance with replacement of the identification information of the failed

8 resource management module by the identification information of the replacement resource
9 management module.

1 14. A disk control device comprising:
2 a plurality of host interface modules configured to interface with a computer;
3 a plurality of disk interface modules configured to interface with a storage
4 device;
5 a plurality of cache memory modules configured to temporarily store data read
6 from or written to the storage device; wherein each of the host interface modules is
7 configured to execute data transfers between the computer and the cache memory modules,
8 and each of the disk interface modules is configured to execute data transfers between the
9 storage device and the cache memory modules; wherein each of the host interface modules,
10 the disk interface modules, and the cache memory modules includes identification
11 information providing unique identification;
12 means for connecting the host interface modules, the cache memory modules,
13 and the disk interface modules; and
14 means for providing a memory containing path information based on
15 identification information for data transfer paths among the host interface modules, the disk
16 interface modules, and the cache memory modules, and for changing the path information for
17 the data transfer paths in the memory, when a failure takes place in one of the cache memory
18 modules, to avoid a failed cache memory module.

1 15. A disk control device as recited in claim 14 wherein each of the cache
2 memory modules is configured to monitor failure in the cache memory module.

1 16. A disk control device as recited in claim 14 further comprising means
2 for changing the identification information.

1 17. A disk control device comprising:
2 a plurality of host interface modules configured to interface with a computer;
3 a plurality of disk interface modules configured to interface with a storage
4 device;
5 a plurality of cache memory modules configured to temporarily store data read
6 from or written to the storage device;

7 a plurality of resource management modules configured to store control
8 information relating to data transfer among the cache memory modules and the host interface
9 modules and the disk interface modules; wherein each of the host interface modules is
10 configured to execute data transfers between the computer and the cache memory modules,
11 and each of the disk interface modules is configured to execute data transfers between the
12 storage device and the cache memory modules; wherein each of the host interface modules,
13 the disk interface modules, the resource management modules, and the cache memory
14 modules includes identification information providing unique identification;
15 means for connecting the host interface modules, the cache memory modules,
16 the resource management modules, and the disk interface modules; and
17 means for providing a memory containing path information based on
18 identification information for data transfer paths among the host interface modules, the disk
19 interface modules, the resource management modules, and the cache memory modules, and
20 for changing the path information for the data transfer paths in the memory, when a failure
21 takes place in one of the cache memory modules or the resource management modules, to
22 avoid a failed module.

1 18. A disk control device as recited in claim 17 wherein each of the
2 resource management modules is configured to monitor failure in the resource management
3 module or in one of the cache memory modules.

1 19. A failure recovery processing method for a disk control device, the
2 method comprising:
3 providing a plurality of host interface modules configured to interface with a
4 computer;
5 providing a plurality of disk interface modules configured to interface with a
6 storage device;
7 providing a plurality of cache memory modules configured to temporarily
8 store data read from or written to the storage device; wherein each of the host interface
9 modules is configured to execute data transfers between the computer and the cache memory
10 modules, and each of the disk interface modules is configured to execute data transfers
11 between the storage device and the cache memory modules; wherein each of the host
12 interface modules, the disk interface modules, and the cache memory modules includes
13 identification information providing unique identification;

14 connecting the host interface modules, the cache memory modules, and the
15 disk interface modules;
16 providing a memory containing path information based on identification
17 information for data transfer paths among the host interface modules, the disk interface
18 modules, and the cache memory modules; and
19 changing the path information for the data transfer paths in the memory, when
20 a failure takes place in one of the cache memory modules, to avoid a failed cache memory
21 module.

1 20. A failure recovery processing method as recited in claim 19 wherein
2 changing the path information comprises changing the identification information.

1 21. A failure recovery processing method as recited in claim 19 further
2 comprising monitoring failure in the cache memory modules.

1 22. A failure recovery processing method as recited in claim 21 wherein
2 each of the cache memory modules is configured to monitor failure in the cache memory
3 module.

1 23. A failure recovery processing method as recited in claim 22 wherein
2 each of the cache memory modules is configured to control changing of the path information
3 when a failure takes place.

1 24. A failure recovery processing method as recited in claim 21 wherein
2 monitoring a failure in one of the cache memory modules takes place during a read or write
3 operation in the host interface module or the disk interface module.

1 25. A failure recovery processing method as recited in claim 19 further
2 comprising:
3 providing a plurality of resource management modules configured to store
4 control information relating to data transfer among the cache memory modules and the host
5 interface modules and the disk interface modules, each of the plurality of resource
6 management modules including identification information providing unique identification;
7 connecting the plurality of resource management modules with the host
8 interface modules, the disk interface modules, and the cache memory modules; and

9 changing the path information for the data transfer paths in the memory, when
10 a failure takes place in one of the resource management modules, to avoid a failed resource
11 management module.

1 26. A failure recovery processing method as recited in claim 25 further
2 comprising monitoring failure in the resource management modules.

1 27. A failure recovery processing method as recited in claim 26 wherein
2 each of the resource management modules is configured to monitor failure in the resource
3 management module or in one of the cache memory modules.

1 28. A failure recovery processing method as recited in claim 27 wherein
2 each of the resource management modules is configured to control changing of the path
3 information when a failure takes place in the resource management module or in one of the
4 cache memory modules.

1 29. A failure recovery processing method as recited in claim 26 wherein
2 each of the resource management modules is configured to control changing of the path
3 information when a failure takes place in the resource management module.

1 30. A failure recovery processing method as recited in 19 wherein
2 changing the path information comprises:
3 swapping the identification information of the failed cache memory module
4 with the identification information of a replacement cache memory module which will inherit
5 functions of the failed cache memory module; and
6 changing the path information for the data transfer paths in the memory based
7 on the swapping of the identification information.

1 31. A failure recovery processing method as recited in claim 19 wherein
2 the storage device comprises a magnetic disk device.

1 32. A disk array system for connecting to a plurality of computers via a
2 first network, the disk array system comprising:
3 a plurality of magnetic disk devices and a disk control device connected via a
4 second network;
5 wherein the disk control device comprises a plurality of host interface modules
6 including an interface with the computers; a plurality of disk interface modules including an

7 interface with the magnetic disk devices; and a plurality of cache memory modules connected
8 between the plurality of host interface modules and the plurality of disk interface modules via
9 a switch network having at least one switch;

10 wherein the plurality of host interface modules, the plurality of disk interface
11 modules, and the plurality of cache memory modules each include an ID providing unique
12 identification within the switch network;

13 wherein the switch includes a memory containing path information based on
14 the IDs for data transfer paths among the host interface modules, the disk interface modules,
15 and the cache memory modules; and

16 wherein the disk control device comprises means for changing the path
17 information in the memory of the switch and the IDs.

1 33. A disk array system as recited in claim 32 wherein each of the plurality
2 of cache memory modules is configured to monitor failure in the plurality of cache memory
3 modules; and to control changing of the path information relating to the cache memory
4 module in the memory of the switch.

1 34. A disk array system as recited in claim 32 further comprising:
2 a plurality of resource management modules configured to store control
3 information relating to data transfer among the cache memory modules and the host interface
4 modules and the disk interface modules, each of the plurality of resource management
5 modules including identification information providing unique identification;

6 wherein the plurality of resource management modules are connected with the
7 host interface modules, the disk interface modules, and the cache memory modules; and

8 wherein each of the resource management modules is configured to control
9 changing of the path information for the data transfer paths in the memory of the switch,
10 when a failure takes place in one of the resource management modules, to avoid a failed
11 resource management module.

1 35. A disk array system as recited in claim 34 wherein each of the resource
2 management modules is configured to monitor failure in the resource management module or
3 in one of the cache memory modules.

1 36. A disk array system as recited in claim 35 wherein each of the resource
2 management modules is configured to control changing of the path information when a

3 failure takes place in the resource management module or in one of the cache memory
4 modules.

1 37. A disk array system as recited in claim 34 wherein each of the resource
2 management modules is configured to monitor failure in the resource management module;
3 and to control changing of the path information when a failure takes place in the resource
4 management module.

1 38. A disk control device comprising:
2 a plurality of host interface modules configured to interface with a computer;
3 a plurality of disk interface modules configured to interface with a storage
4 device;
5 a plurality of cache memory modules configured to temporarily store data read
6 from or written to the storage device; and
7 a switch network connecting the host interface modules, the cache memory
8 modules, and the disk interface modules, the switch network comprising a processor and a
9 memory storing a program executable by the processor;
10 wherein each of the host interface modules is configured to execute data
11 transfers between the computer and the cache memory modules, and each of the disk
12 interface modules is configured to execute data transfers between the storage device and the
13 cache memory modules;
14 wherein each of the host interface modules, the disk interface modules, and the
15 cache memory modules includes identification information providing unique identification
16 within the switch network;
17 wherein the memory of the switch network includes path information based on
18 the identification information for data transfer paths among the host interface modules, the
19 disk interface modules, and the cache memory modules; and
20 wherein the program in the memory of the switch network includes a code
21 module for changing the path information relating to the cache memory modules in response
22 to an instruction from one of the cache memory modules upon detecting failure in the cache
23 memory module.

1 39. A disk control device as recited in claim 38 further comprising a
2 plurality of resource management modules configured to store control information relating to
3 data transfer among the cache memory modules and the host interface modules and the disk

4 interface modules, and wherein the program in the memory of the switch network includes a
5 code module for changing the path information relating to the resource management modules
6 in response to an instruction from one of the resource management modules upon detecting
7 failure in the resource management module.